



Shear

***A contributory factor in
pressure ulceration***

**A presentation aimed at clinicians
and associated professionals**



Introduction

Although shear is understood to be a major contributor to the formation of pressure ulcers, the measurement of shear and how shear contributes to the formation of pressure ulcers have not yet been fully established.

In 2005, an international consensus group, the Shear Force Initiative' (SFI) was created in order to explore the current level of knowledge and to shape future research.

Mission Statement

To define, study and measure shear and its effect on the various physiological, metabolic and physical characteristics that influence the assessment, prevention, treatment and development of pressure ulcers in order to improve patient management.



Shear:

What DO we know?

This section represents the evidence for the role of shear in pressure ulceration based upon an extensive literature review and the agreement of the expert panel



Shear: What DO we know?

● We know that...

...shear is a ***normal*** mechanical force
with physiological effects

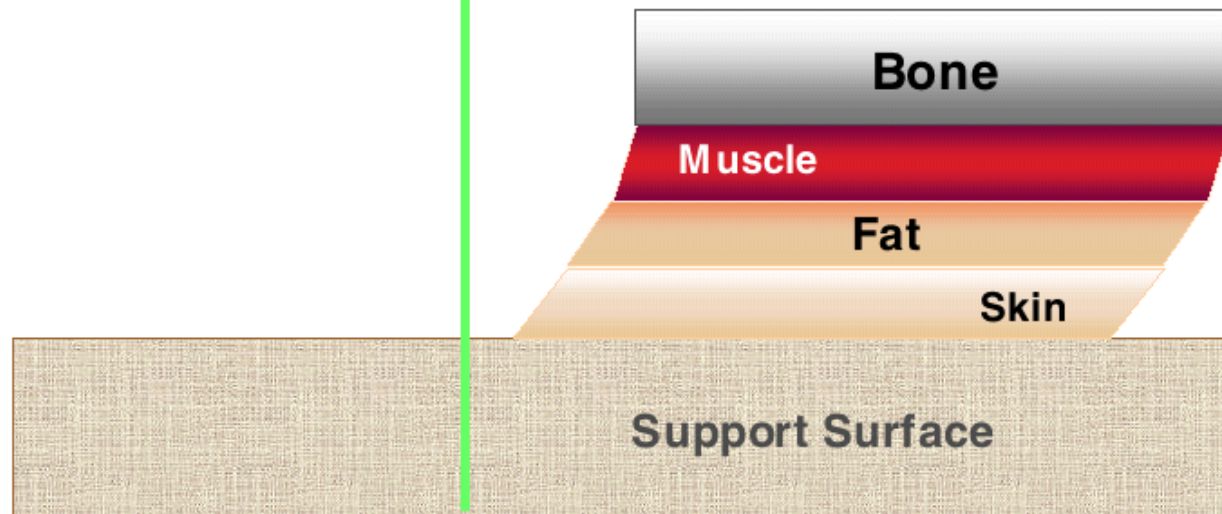


Shear: *What DO we know?*

Defining Shear

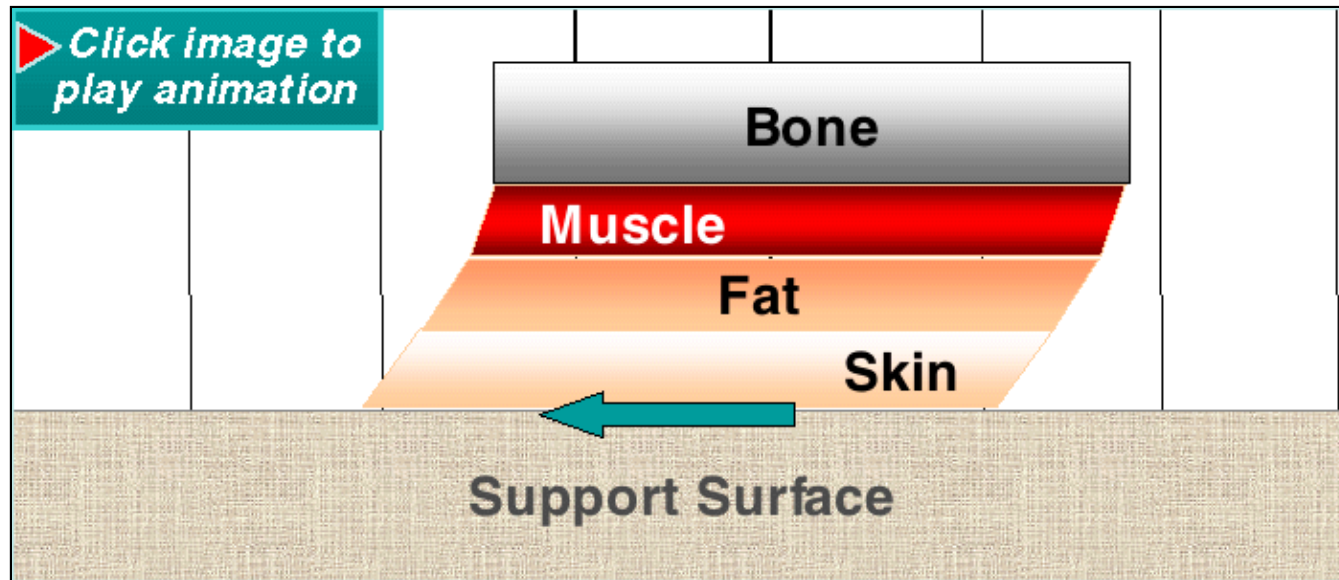
An action or stress resulting from applied forces which causes or tends to cause two contiguous internal parts of the body to deform in the transverse plane (i.e. shear strain)

▶ Click image to play animation



Shear: What DO we know?

Visualizing Shear



Shear: What DO we know?

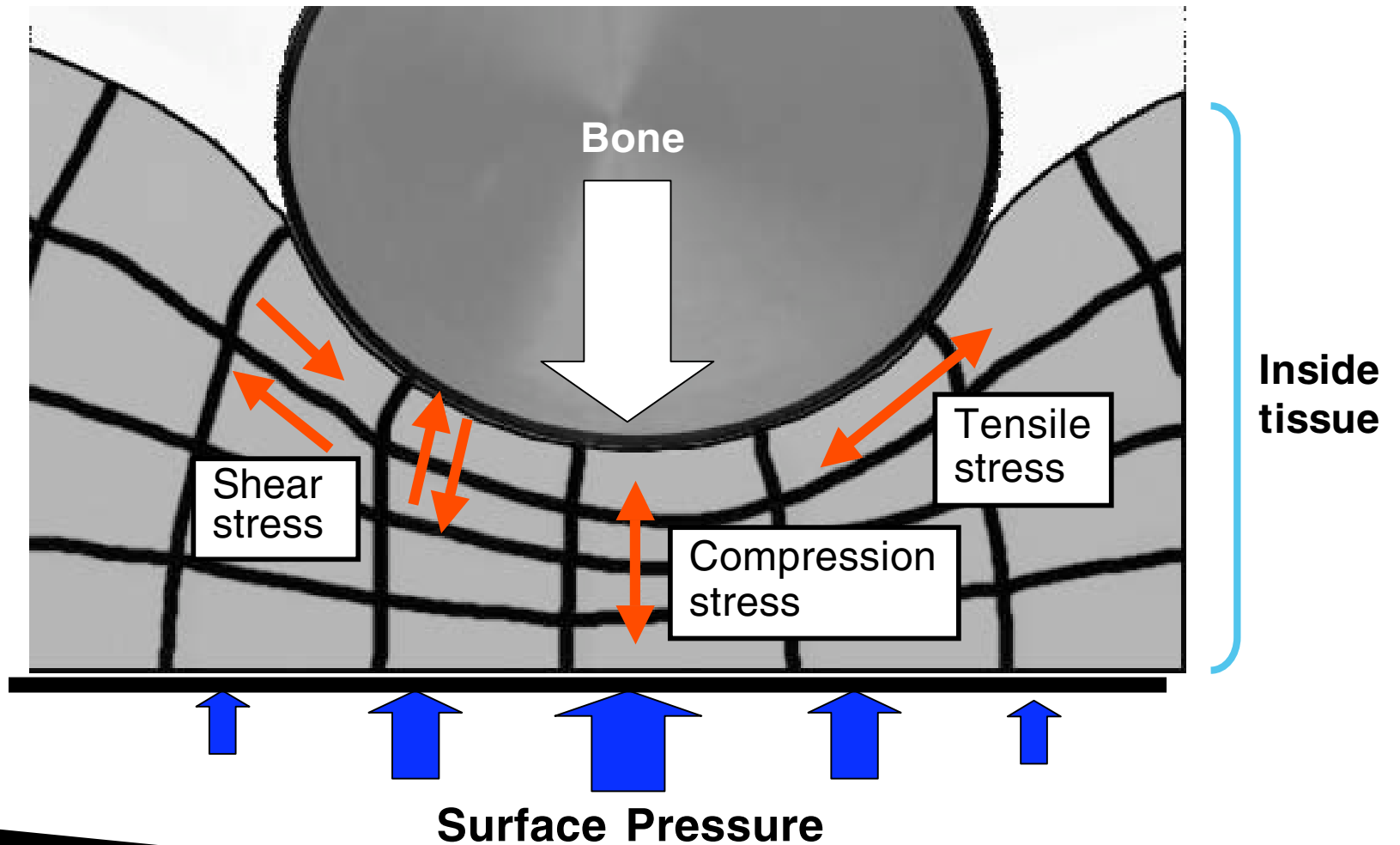
● We know that...

...load has an *internal* effect or
influence on the tissue



Shear: What DO we know?

Distribution of stresses inside tissue from the view of biomechanics



Shear: What DO we know?

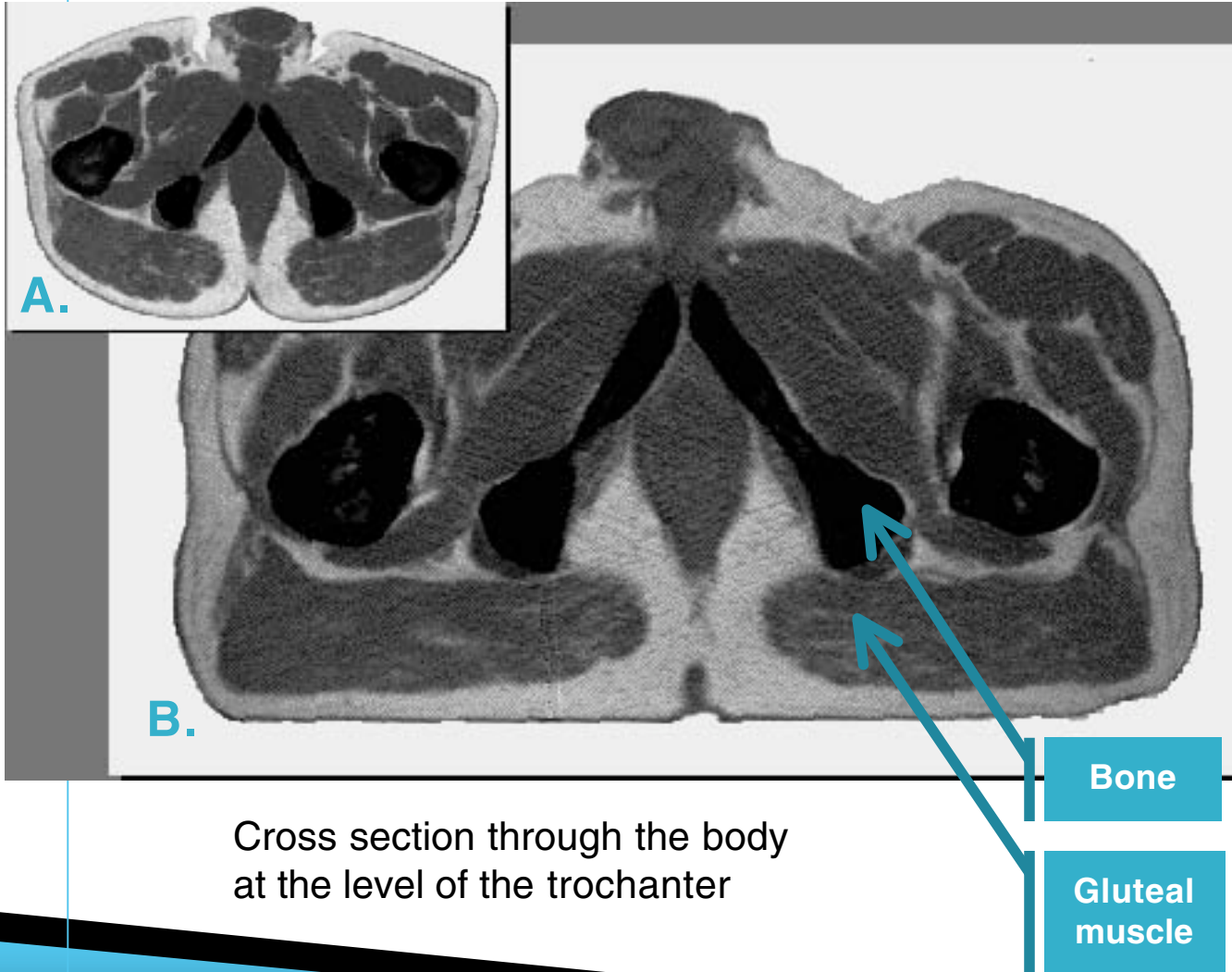
● We know that...

... shear occurs
even when lying *flat*



Shear: What DO we know?

Shear occurs even when laying flat



Magnetic Resonance Imaging (MRI)

A. The inset slide shows the tissue over the buttocks when completely off-loaded.

B. When the body is resting on a solid surface, the extent of distortion (spread) in the muscle can be visualised.

Shear: What DO we know?

● We know that...

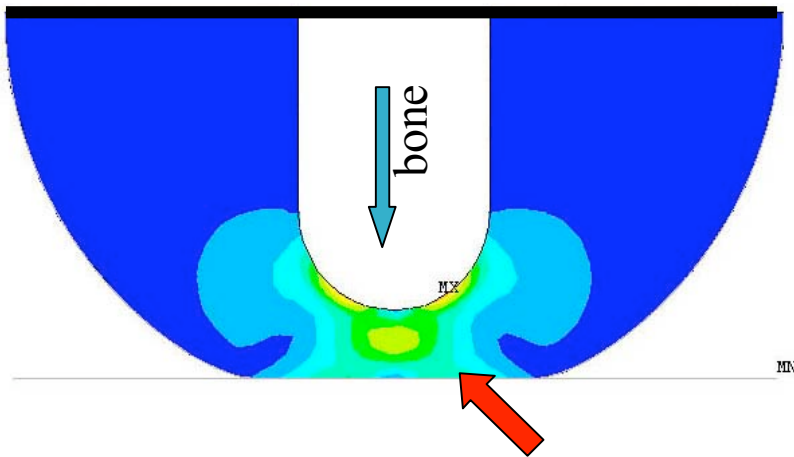
... if pressure remains constant and we increase shear, the deformation of soft tissue may be greater.



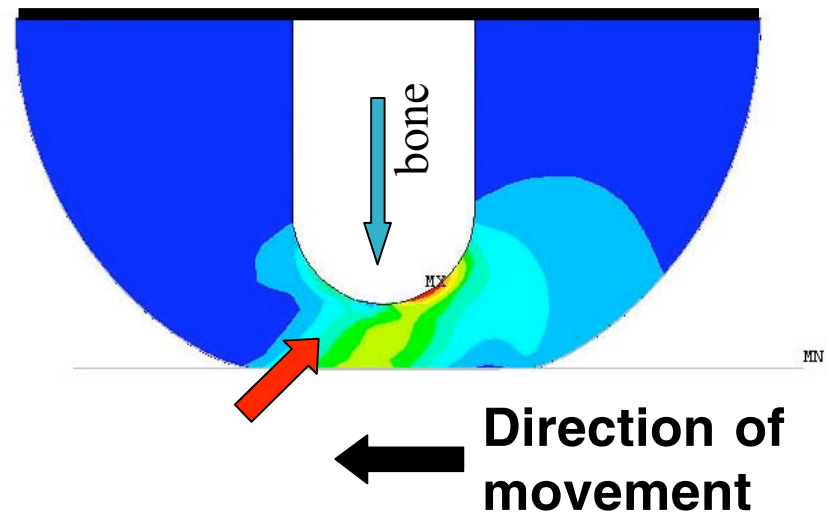
Shear: What DO we know?

Movement influences shear forces

Pressure: 8mmHg
Lateral movement: None



Pressure: 8mmHg
Lateral movement: **Only 5mm!**



**Movement increases
strain in deep tissues**

Shear: What DO we know?

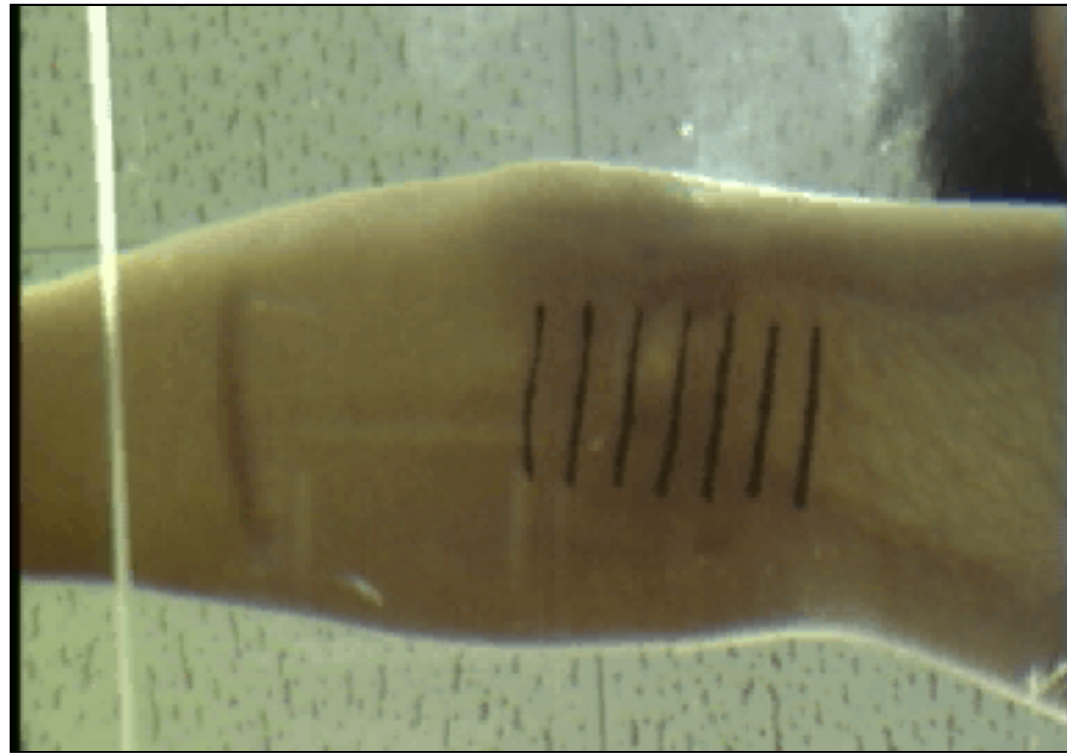
We know that...

... changes in position or posture
are likely to change shear
externally and internally

Shear: What DO we know?

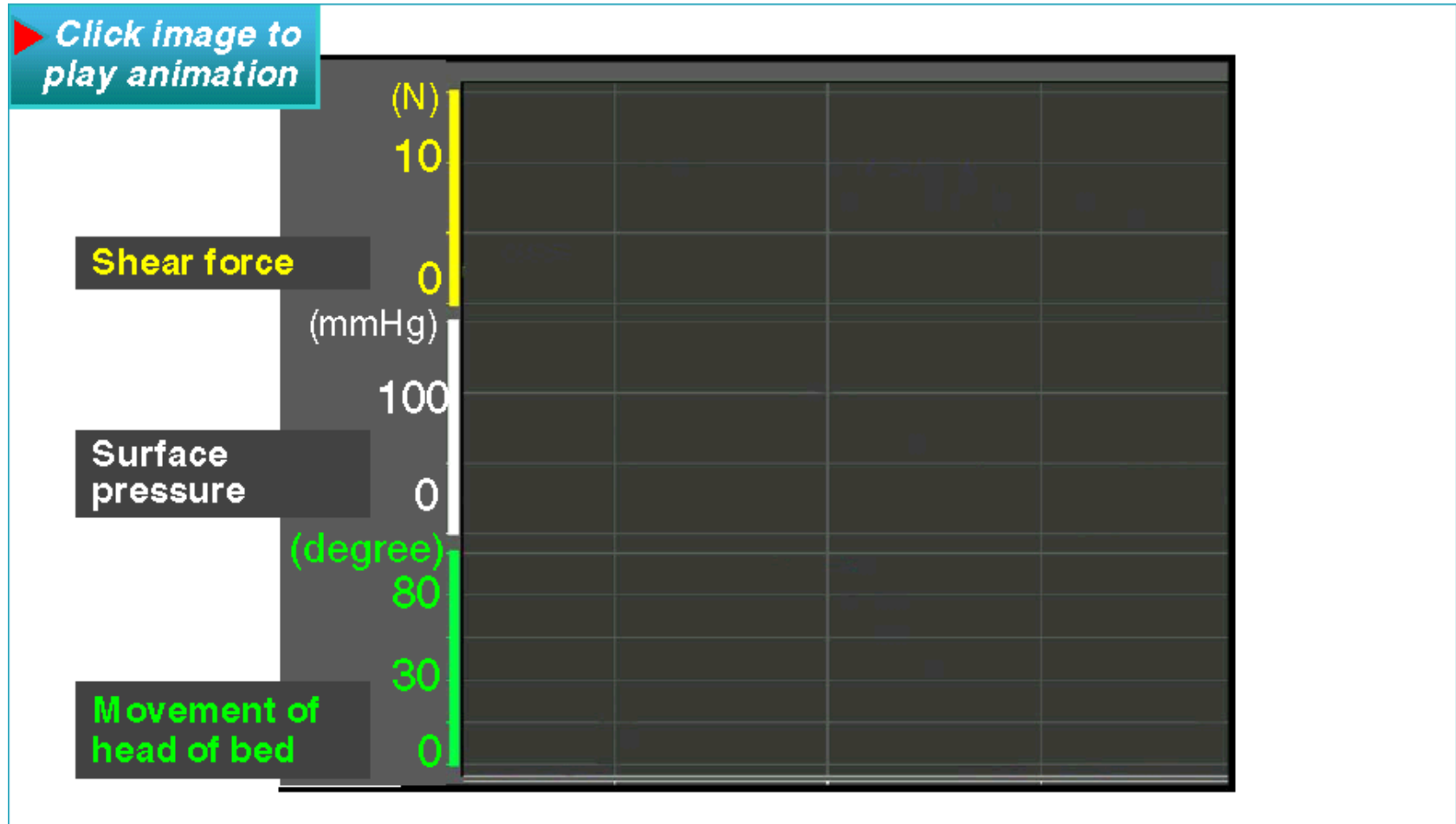
Shear force occurring when the head of the bed is raised and lowered

▶ *Click image to
play animation*



Shear: What DO we know?

An example of residual shear

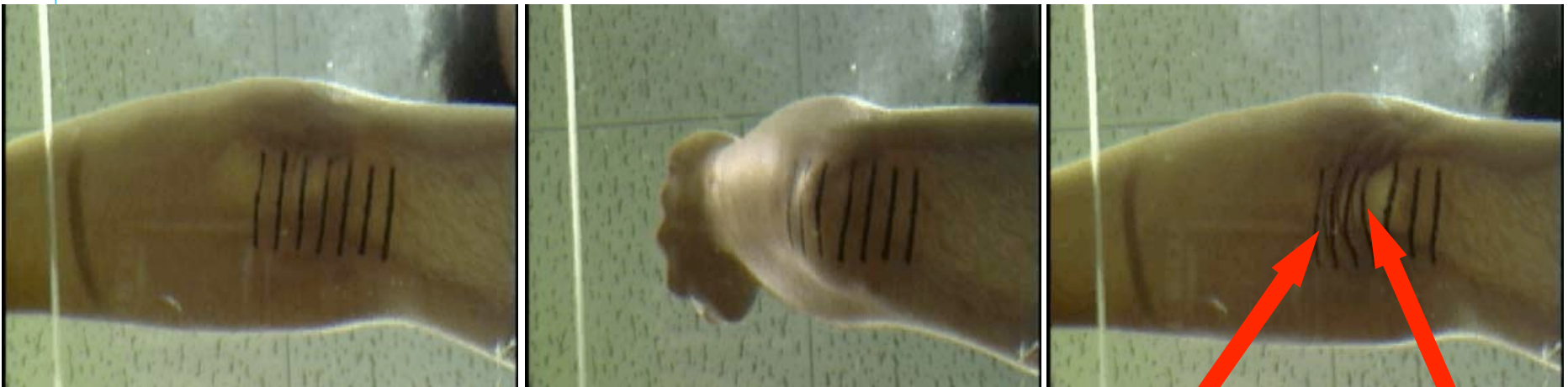


Shear: What DO we know?

Deformation and ischemia can occur while the elbow is bending and stretching.

Before movement

After movement



Deformation

Blanching

Shear: What DO we know?

Measurement of shear is not easy

- The complexity of shear measurements requires close attention to both patient safety and potentially confounding influences.
- A guidance document has been produced to aid in:
 - Calibration and validation of shear measurement devices
 - Laboratory / bench measurement of shear
 - Clinical measurement of shear with respect to:
 - Patient safety
 - Data validity
 - See the document “Suggested Shear Measurement Guidance” available at the SFI (<http://shearforceinitiative.com/>) and NPUAP (www.npuap.org) websites



Shear:

What we DO NOT know

This section illustrates the areas where evidence is lacking and highlights the areas where further research is needed



Shear:



● We don't know...

... how shear actually causes
tissue damage.



Shear:



● We don't know...

... what is the relationship between
shear force and time?

*Although pressure ulceration is associated with shear,
it is as yet unclear as to the exact relationship between
shear and its duration that causes damage*



Shear:



● We don't know...

... whether shear damages muscle
more than skin or fat.

*It is unclear whether certain tissues are more
susceptible to shear forces*



Shear:



● We don't know...

... which patients are at greatest risk
of shear injury.

There is insufficient knowledge about the characteristics of shear, and the influence it has on tissue, to reliably predict those at greatest risk.



Shear:



We don't know...

... the relationship between external
and internal shear.

While tools have been developed to try to measure shear at the skin surface there is insufficient knowledge about its effect in deeper tissue.



Shear:



● We don't know...

... what effect postural changes
(frequency and/or speed)
have on shear force.

*Shear models show that shear changes with movement but
whether these effects influence tissue damage is unknown.*





Shear:

Practical Suggestions



Practical suggestions to reduce the amount of shear force exerted on the tissue:

- Assist the patient to adopt a stable posture using aids when necessary
- Reduce the chance of sliding down in the bed
- Reduce the chance of sliding in a chair
- When repositioning patients **LIFT**
don't **DRAG**

Summary

- Shear is a normal mechanical force with physiological effects
- Shear is difficult to measure
- It is unclear how shear actually causes tissue damage
- Changes in position or posture are likely to change shear externally (friction) and internally (shear strain)

Further Reading

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Le KM, Madsen BL, Barth PW, et al. : An in-depth look at pressure sores using monolithic silicon pressure sensors. Plast Reconstr Surg. 74:745-756, 1984

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Ohura T, Takahashi M, Ohura N. Jr. : Influence of External Force (Pressure and Shear Force) on Superficial Layer and Subcutis of Porcine Skin and Effects of Dressing Materials. Wound Repair and Regeneration, 2007; in press.

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FOR A COMPREHENSIVE LIST OF SHEAR-RELATED REFERENCES GO TO www.shearforceinitiative.com

Glossary

COEFFICIENT OF FRICTION :

A measurement of the amount of friction existing between two surfaces for a given force tending to hold the surfaces together.

FRICTION :

The resistance to motion of the external tissue sliding in a parallel direction relative to the support surface resulting in external tissue damage.

PRESSURE :

The force per unit area exerted perpendicular to a surface.

SHEAR :

An action or stress resulting from applied forces which causes or tends to cause two contiguous internal parts of the body to deform in the transverse plane (i.e., shear strain).